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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/705,960

11/13/2003

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Q77682

6715

23373 7590 04/03/2007
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EXAMINER

FINDLEY, CHRISTOPHER G

ART UNIT

PAPER NUMBER

2621

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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3 MONTHS

04/03/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/705,960

Applicant(s)

SONG ET AL.

Examiner

Christopher Findley

Art Unit

2621

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>1/12/2006, 9/09/2005.</u> | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. **Claims 1-3 and 6-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bakhmutsky et al. (US 6519005 B2) in view of Lim (US 6430223 B1).**

Re claim 1, Bakhmutsky discloses a video encoding/decoding method based on interlaced frame motion estimation and/or compensation, the method comprising: (a) receiving a macroblock as a received macroblock and a search range and estimating a frame motion vector for each integer pixel (column 4, lines 8-25); (b) matching bottom field pixels in the received macroblock with top field pixels in a reference frame that correspond to locations indicated by a frame motion vector whose vertical component has been scaled according to field-to-field distances, and matching top field pixels in the

received macroblock with bottom field pixels in the reference frame that correspond to the frame motion vector, if the vertical component of the frame motion vector estimated in step (a) is an odd value (column 8, lines 43-48); and (c) matching the top or bottom field pixels in the received macroblock with the top or bottom field pixels in the reference frame that correspond to the frame motion vector, if the vertical component of the frame motion vector estimated in step (a) is an even value (column 8, lines 34-39).

Bakhmutsky does not specifically state that the motion vectors are scaled. However, Lim discloses a motion prediction apparatus and method in which a scalar scales each motion vector outputted from the first motion estimator to determine a field motion vector (Abstract section; Figs. 9A-C and 10A-C; Equations (5)-(11)). Since both Bakhmutsky and Lim disclose motion estimation techniques for interlaced digital video, one of ordinary skill in the art at the time of the invention would have found it obvious to combine their teachings in order to accurately estimate motion between top and bottom fields, thus eliminating interlacing artifacts in the reconstructed video.

Re claim 2, Bakhmutsky discloses that the bottom field pixels in the macroblock are matched with top field pixels in the reference frame that are adjacent to the locations indicated by the frame motion vector, and motions between the bottom field pixels and the top field pixels are estimated and/or compensated for based on the frame motion vector for each integer pixel (Abstract section; column 8, lines 14-48).

Re claim 3, Bakhmutsky discloses that the bottom field pixels in the macroblock are matched with bottom field pixels in the reference frame that are adjacent to the locations indicated by the frame motion vector, and motions between the bottom field

pixels and the top field pixels are estimated and/or compensated for based on the frame motion vector for each integer pixel (Abstract section; column 8, lines 14-48).

Re claim 6, Bakhmutsky does not specifically state that the motion vectors are scaled. However, Lim discloses an image encoding scheme in which two or more different sets of motion vectors are generated for each image that is to be encoded using motion estimation. Lim's coding scheme scales the motion vectors between fields of opposite parity (Figs. 9A-C and 10A-C; Equations (5)-(11); MVbt and MVtb).

Although the scaling performed by Lim scales the vector by a factor of the distance between fields of opposite parity divided by the distance between fields of same parity, The Examiner takes Official Notice that one of ordinary skill in the art at the time of the invention would have found it obvious that the scaling factor is an arbitrary value determined by the system designer to adjust the accuracy of the motion estimation/compensation, and as such can be comprised of any ratio of field distances that is deemed appropriate by the designer for the computation and quality requirements of the system. Since both Bakhmutsky and Lim disclose coding techniques for interlaced digital video, one of ordinary skill in the art at the time of the invention would have found it obvious to combine their teachings in order to accurately estimate motion between top and bottom fields, thus eliminating interlacing artifacts in the reconstructed video.

Re claim 7, Bakhmutsky discloses a method of encoding/decoding an interlaced video, the method comprising: (a) setting a macroblock as a set macroblock and a search range for image data (Figs. 2B and 4B; column 7, lines 27-61); (b) determining

whether a vertical component of a motion vector for each of integer pixels in the set macroblock is an even or odd value, and matching top and bottom field pixels in the set macroblock with field pixels in a reference frame that correspond to locations indicated by one of the motion vector and a motion vector that is estimated depending on the locations of pixels (Abstract section; column 8, lines 14-48); and (c) if the motion vector for each of the integer pixels of the macroblock has been completely estimated in step (b), matching the top/bottom field pixels in the set macroblock in the reference frame that correspond to the motion vector, wherein the matching is performed according to the vertical component of the motion vector (column 8, lines 14-48).

Bakhmutsky does not specifically state that the motion vectors are scaled or that the motion estimation is performed with half pel (or half pixel) resolution. However, Lim discloses a motion prediction apparatus and method in which a scalar scales each motion vector outputted from the first motion estimator to determine a field motion vector (Abstract section; Figs. 9A-C and 10A-C; Equations (5)-(11)). Lim also discloses that a second motion estimator predicts a motion in a half pixel unit by retrieving a decoded image on a basis of each single-pixel motion vector outputted from the first motion estimator, the frame vector determining circuit and the scalar (Abstract section). Since both Bakhmutsky and Lim disclose motion estimation techniques for interlaced digital video, one of ordinary skill in the art at the time of the invention would have found it obvious to combine their teachings in order to accurately estimate motion between top and bottom fields, thus eliminating interlacing artifacts in the reconstructed video.

Re claim 8, Bakhmutsky discloses matching the top or bottom field pixels in the macroblock with the top or bottom field pixels in the reference frame that correspond to the motion vector, if the vertical component of the motion vector for each of the integer pixels in the set macroblock is an even value (column 8, lines 34-39); and matching the bottom field pixels in the macroblock with the top field pixels in the reference frame that correspond to an extended motion vector of the motion vector that is extended depending on distances between fields to be matched, if the vertical component of the motion vector for each of the integer pixels in the set macroblock is an odd value (column 8, lines 43-48).

Re claim 9, Bakhmutsky discloses top-top or bottom-bottom estimation if the vertical component of the motion vector is even (column 8, lines 34-39), and performing top-bottom or bottom-top (bilinear) estimation if the vertical component is odd (column 8, lines 43-48). Bakhmutsky does not specifically state that the motion estimation is performed with half pel (or half pixel) resolution. However, Lim discloses that a second motion estimator predicts a motion in a half pixel unit by retrieving a decoded image on a basis of each single-pixel motion vector outputted from the first motion estimator, the frame vector determining circuit and the scalar (Abstract section). Since both Bakhmutsky and Lim disclose motion estimation techniques for interlaced digital video, one of ordinary skill in the art at the time of the invention would have found it obvious to combine their teachings in order to accurately estimate motion between top and bottom fields, thus eliminating interlacing artifacts in the reconstructed video.

Re claim 10, Bakhmutsky discloses producing information that represents whether the vertical component of the motion vector for each of the integer pixels estimated is an odd or an even value (Fig. 3; column 8, line 49, through column 9, line 35).

Re claim 11, arguments analogous to those presented for claim 7 are applicable to claim 11. Bakhmutsky discloses determining whether a vertical component of a motion vector for each integer pixel in a macroblock is an even or an odd value when the incoming image data of a current frame is compared with image data of a previous frame stored in the frame memory, and if the vertical component of the motion vector is an odd value, matching bottom field pixels with top or bottom field pixels in the previous frame (Abstract section; column 8, lines 14-48).

Bakhmutsky does not specifically disclose that the motion vector is scaled depending on distances between fields to be matched or the individual elements of the encoder (discrete cosine transform unit, quantization unit, dequantization unit, inverse discrete cosine transform unit, frame memory, motion estimation/motion compensation unit). However, Lim discloses a motion prediction apparatus and method in which a scalar scales each motion vector outputted from the first motion estimator to determine a field motion vector (Abstract section; Figs. 9A-C and 10A-C; Equations (5)-(11)). Furthermore, Lim explicitly discloses a Discrete Cosine Transfer (DCT) unit (Fig. 1/6), a quantizer unit (Fig. 1/8), an inverse quantizer (Fig. 1/12, performs dequantizing), an inverse DCT (IDCT) unit (Fig. 1/14), a frame memory (Fig. 1/ 2), and a motion estimation/motion compensation unit (Fig. 1/20). All of the above-listed elements are

conventional elements in a standard MPEG encoder. Since both Bakhmutsky and Lim disclose motion estimation techniques for interlaced digital video, one of ordinary skill in the art at the time of the invention would have found it obvious to combine their teachings in order to accurately estimate motion between top and bottom fields, thus eliminating interlacing artifacts in the reconstructed video.

Re claim 12, arguments analogous to those presented for claim 7 are applicable to claim 11. Bakhmutsky discloses determining whether a vertical component of a motion vector for each integer pixel in a macroblock is an even or an odd value when the incoming image data of a current frame is compared with image data of a previous frame stored in the frame memory, and if the vertical component of the motion vector is an odd value, matching bottom field pixels with top or bottom field pixels in the previous frame (Abstract section; column 8, lines 14-48).

Bakhmutsky does not specifically disclose that the motion vector is scaled depending on distances between fields to be matched or the individual elements of the decoder (dequantization unit, inverse discrete cosine transform unit, frame memory, motion estimation/motion compensation unit). However, Lim discloses a motion prediction apparatus and method in which a scalar scales each motion vector outputted from the first motion estimator to determine a field motion vector (Abstract section; Figs. 9A-C and 10A-C; Equations (5)-(11)). Furthermore, Lim explicitly discloses an inverse quantizer (Fig. 1/12, performs dequantizing), an inverse DCT (IDCT) unit (Fig. 1/14), a frame memory (Fig. 1/ 2), and a motion estimation/motion compensation unit (Fig. 1/20). All of the above-listed elements are conventional elements in a standard MPEG

decoder. Since both Bakhmutsky and Lim disclose motion estimation techniques for interlaced digital video, one of ordinary skill in the art at the time of the invention would have found it obvious to combine their teachings in order to accurately estimate motion between top and bottom fields, thus eliminating interlacing artifacts in the reconstructed video.

4. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bakhmutsky et al. (US 6519005 B2) and Lim (US 6430223 B1) as applied to claims 1-3 and 6-12 above, and further in view of Suga (US 6707467 B1).

Re claims 4 and 5, neither Bakhmutsky or Lim disclose replacing the pixel value of a pixel located between two lines of the same field with the pixel value of the pixel located on the line nearest (in the vertical direction) to the pixel between the lines. However, Suga discloses an image processing apparatus and method wherein the above-described operation (known as nearest-neighbor interpolation) is performed (Fig. 6; column 7, lines 46-64). Since Suga relates to improved resolution in a video stream, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Suga with Bakhmutsky and Lim in order to provide an output video stream with the highest quality picture possible.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- a. Motion vector generation by temporal interpolation
Lee (US 6317460 B1)

- b. Dual-prime motion estimation engine

Kohn (US 6501799 B1)

- c. Device and method for decoding HDTV video

Kin et al. (US 6104753 A)

- d. Adaptive deinterlacing applied to HDTV coding

Zaccarin, A.; Liu, B.

Circuits and Systems, 1992. ISCAS '92. Proceedings., 1992 IEEE International Symposium on

Volume 1, 3-6 May 1992 Page(s):455 - 458 vol.1

Digital Object Identifier 10.1109/ISCAS.1992.229915

- e. Coding of interlaced sequences using a decoder-based adaptive deinterlacer

Zaccarin, A.; Liu, B.;

Acoustics, Speech, and Signal Processing, 1993. ICASSP-93., 1993 IEEE International Conference on

Volume 5, 27-30 April 1993 Page(s):377 - 380 vol.5

Digital Object Identifier 10.1109/ICASSP.1993.319826

Contact

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher Findley whose telephone number is (571) 270-1199. The examiner can normally be reached on Monday-Friday 7:30am-5pm, Alternate Fridays off.

Art Unit: 2621

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mehrdad Dastouri can be reached on (571) 272-7418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Christopher Findley/

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